

# MEMOIRS FOR THE INGENIOUS. CONTAINING

Several Curious Observations in *Philosophy, Mathematicks, Physick, History, Philology, and other Arts and Sciences.*

IN  
Miscellaneous Letters.

By *J. DE LA CROSE*, Eccl. Angl. Presb.

MAY, 1693.

To be continued Monthly.

VOL. I.

*Labor molestus iste fructi est optimi.* Auson. Sap.

*Scilicet ingenuas didicisse fideliter artes,  
Emollit mores, nec finit esse feros.* Ovid.

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Where are to be had the Memoirs for *January, February, March,*  
and *April.*

Y

# MEMOIRS

## ADDITIONAL

THE Ingenious, who have any Papers to communicate to the Author of these *Memoirs*, are intreated to direct them to his Lodgings, at Mr. Fage's a Turner, in Play-houſe-yard, near the Thistle and Crown, in Blackfryars.

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May, 1693,

( 135 ) Vol. I. Numb. 5.

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# Memoirs for the Ingenious.

MAY, 1693.

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## LETTER XVIII.

To the Reverend Mr. Milbourne.

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### ARGUMENT.

Remarks upon the VIII<sup>th</sup>. Letter of these Memoirs. Whether it favours the Doctrins of the Roman Church, which the Protestants reject. Difference between Transubstantiation, and the Mystery of the Holy Trinity. Two ways by which the Orthodoxes use to explain that Mystery. The method of the ancient Fathers in teaching the Gospel. Observations on a Socinian Pamphlet, wherein is shewn, That the Account the Socinians give of the Corruption of the Christian Doctrin, as to this Point, is altogether improbable.

Reverend SIR,

I Did flatter my self, that some of our learned Divines should vouchsafe to make Observations on the VIII<sup>th</sup>. Letter of these *Memoirs*: However I have not receiv'd nor heard of any, tho' the Subject be of the highest consequence, and the Objections somewhat uncommon. So that what I was afraid of, has befallen me, namely, That I should be forced to answer them my self, lest the Enemies of the Orthodox Faith, or some malicious Adversary should

take advantage of my Silence: neither could I dedicate this Letter more properly than to a Divine, who has shew'd so much Zeal and Learning both <sup>(a)</sup> against the new Upstarts, the Revivers of the

(a) Mysteriæ in Religione vin-  
dicated. ancient Heresies, as also against <sup>(b)</sup> the elder Corrupters of Christianity and Tradition.

Some People have imagin'd that the Hypothesis proposed in the (b) A short said Letter, favoured the Superstitions that have crept into the Defence of Church in latter Ages: For, say they, if the Primitive Christians the Orders thought fit to conceal the Mystery of the Holy Trinity from the knowledge of the Vulgar, for fear of exposing it to the Cavils and Derision of the Heathens; there was the same Reason for keeping private the Doctrin of Transubstantiation, which is no less incomprehensible and liable to Objections, as appears by those the Protestants make against it. The worship also of Images, and the invocation of Saints, might have induced the unfaithful to believe, that Christianity differ'd only from Paganism in the object of Adoration; that nothing was chang'd but the outward face of things, and *Jewish* and *Christian* Heroes put in the room of the *Grecians* and *Ægyptians*: and therefore that it was as good still to venerate their own, as to grow fond of those Strangers.

But unhappily for the Objectors, there is not the least mention made either in the Holy Writ, or in the Anti-nicene Fathers of their new Mysteries, which for that Reason, and several others, the Reformed Churches do not stick to name Superstitious. There is not so much as the least hint of a change of substance in the Bread and Wine of the Holy Eucharist, nor any Command of adoring those Elements, of worshipping the Images, or calling upon the deceased. It's true, that those consecrated Elements bear the glorious name of the *Body and Blood of Christ*, and that we are order'd to *eat and drink* them: but besides the figurative sense that these expressions may be taken in, the utmost that they may amount to, is a *Consubstantiation*, which is neither absurd nor impossible, since Bodies can be intimately united with one another, especially by their *Effluviums*, as may be seen in the 16<sup>th</sup> Letter of these *Memoirs*.

Had the Doctrin of the Holy Trinity been thus entirely conceal'd, it would be an intolerable Tyranny to impose it upon others as a Holy Mystery, and the foundation of Christian Religion; but since the Scripture and the most ancient Fathers call the Son and the Holy Ghost God, and ascribe to them the supreme Perfection, or the incommunicable Attributes of the Divinity, as infinite Wisdom, Power and Goodness, all the Question runs about the *modus*, or the manner, in which these three infinite Persons or intelligent Beings

ings are one and the same God, or possess indivisibly the sovereign Perfection. There is scarce any thing, whereof we understand perfectly the inward nature or manner of being, not even of the Air we respire, of the Body we live in, or of the Soul that actuates us ; so that without an unheard of presumption, we cannot pretend to reach to a plainer and compleater knowledge of the nature of God, or of the manner of being of the sovereign and infinite Perfection, than that which he has been pleas'd to reveal to us by the light of Scripture and Reason.

I can forgive the *Roman Catholicks* comparing Transubstantiation, and the Mystery of the Holy Trinity, as to Unconcealableness, because of the prejudices of their Education ; but can hardly have so much condescension for other Christians, who ought to be better informed of the difference that there is betwixt unconceivable and unimaginable, contradictory and not perfectly known, at least before they offer so confidently such odious Comparisons. The best Account that can be given of Transubstantiation, is that of *Robaut*, *viz.* That tho' the substance of the Bread and Wine in the Holy Eucharist be wholly changed into that of the Body and Blood of Christ, yet God wills that these Elements continue to reflect the light, and to affect the Taste and other Senses, just as they did before that miraculous change. If there were nothing else in it, this would be indeed a very incredible Mystery, but not altogether incomprehensible, since God is infinite in power; and that as during sleep our Brains may be moved different ways, without external objects ; so he may move them at the presence of an object, quite differently from what he did before at the presence of the same object, if he be pleas'd to change or to interrupt the natural Laws on a sudden. But this pretended Mystery implies something more, *viz.* a plain and perfect Contradiction : For the *Roman Catholicks* do not say, That Christ's Body is present in the Holy Eucharist by any emanations of his Substance, which would have some appearance of Reason, as may be observed in the said 16<sup>th</sup>. Letter ; but they pretend that Christ's Body is locally and circumspectively in Heaven, and at the same time and in the same manner in several places of the Earth, tho' it be not in the interjacent spaces. Nay, they go so far as to assert, that this Holy Body is intirely and circumspectively present in each physical particle of the consecrated Bread and Wine, and is still however one and the same numerical Body ; than which, nothing can be more absurd and contradictory : for it includes, that several Unities are but one Unity ; or which is the same, several individual Bodies one individual Body.

But as to the Holy Trinity, there is no real Contradiction in it; for no Orthodox Divine did ever say, That the three Divine Persons are but one Person, or that they are three distinct Gods, and but one numerical God. They only say, that the Father, the Son, and the Holy Ghost, are one and the same God, or have one and the same numerical essence and substance. True it is, that when they will give a more distinct Notion of that sacred Mystery, they seem to explain it two different ways. Some say, that the three Divine Persons are as many *modi subsistendi*, three distinct manners of being of the Divinity, the Father the Origin and Principle of the Deity, the Son his eternal Wisdom, and the Holy Ghost their eternal and mutual love; and in that sense it is no more difficult to conceive how the Father, the Son, and the Holy Ghost, are one and the same God, than how the Understanding, the Will, and the sensitive Faculty constitute one and the same Soul.

There are others, who seeing that all the properties of Spirits are ascribed to each of the Divine Persons, understand by that word *Suppositum Intelligens*, an Intelligent Being, and do not stick to call them three Infinite Minds; but then they take the Name of *GOD* as an Appellative, by which is understood the Divine Essence, or the sovereign Perfection, equally and indivisibly possest by the Father, the Son, and the Holy Ghost.

Each of these Opinions has ancient Fathers and Doctors of the Church for its Abettors; and you know, Sir, that they are not irreconcileable, as I might easily make out, but that it would carry me too far from my Subject, and therefore I refer the Reader to Dr. *Sherlock's Vindication of the Holy Trinity*, p. 83, 84.

But to come to the matter in hand; All the Passages quoted in the 8<sup>th</sup> Letter, amount to no more than this, 1. That Piety, or the Love of God and Religion, taught the ancient Fathers a plainer and safer way of arguing, than the subtle Rules of Rhetorick and Logick did the Heathen Orators and Philosophers; namely, to begin with the most simple and perspicuous Truths, and to lay them down as Axioms, whence the more remote and less evident Propositions are to be drawn. Thus the Truths concerning the Unity of God, his Providence, and the future state of Men, being the most incontestable, were to be first inculcated and thoroughly proved to the new Converts, that they might be fitly prepar'd to receive the Doctrins concerning the coming of Sin into the World, the Love of God to Mankind, the sending of his Son into the World, &c. 2. This method agreed extreamly well with the *genius* of the Christian Religion, that is, a most pure and perfect Philosophy, which receives

no Article for fundamental, but what can be prov'd by the light of Reason, or by the testimony of visibly inspired Men. 3. Pastors are spiritual Physicians, who ought to apply their first care to cure such Diseases as are most apparent and dangerous: Now every one knows that *Natural Religion*, which is the foundation of the *Christian*, had been utterly defaced, and Morality abominably corrupted by the *Heathens*, in their setting up of Polytheism and wicked Gods; and therefore these two fundamental Errors were to be remov'd, that a foundation for revealed Truths might successfully be laid. 4. The Pride of Men makes them apt to reject such things as they cannot easily apprehend; but 'tis plain that the Mystery of the Holy Trinity supposes not only the knowledge and persuasion of the natural Religion, and of the Old Testament, but even of most of the Truths of the *Gospel*; no wonder therefore if the ancient Fathers did not teach it the *Catechumens*, till they were very far advanced. 5. As we are born and live among Christians, so our Teachers do commonly use a synthetical method, beginning with the most difficult Problems, as the Divinity of Christ, his Incarnation, the Holy Trinity, &c. because there is no fear of our Apostatizing to Heathenism: Besides, that they may rationally suppose, that in so great a light as the Profession of Christianity has afforded us, none but lewd and profligate Men can doubt of the fundamental Truths; so that they have only to prove those revealed Conclusions, which the Pride and Pertinacy of Hereticks do still stiffly deny. But if the ancient Fathers, in the midst of Persecution, surrounded, as they were, with Enemies on all sides, had delivered the highest Mysteries to the first that desired to be instructed in them, without a previous examination of their Faith and Knowledge, they had exposed them to the derision of the Heathens, and, in all likelihood, Christianity would never have been propagated so far as it has been by the wise course they took. 6. The *Gnosticks*, of whom most of the old Hereticks are the unlucky Brood, did not take from the Christians their mysterious way of concealing their Doctrin; but rather from the *Platonists*, whose Offspring they were; as will plainly appear to any one that shall compare the Tenets and Morals of both. *Plato*, fearing the fate of *Socrates* his Master, kept private the truths of the Unity of God, and of the Vanity of Idolatry, which he communicated only to his most trusty Disciples, and spoke of it but obscurely in his Writings. And that he might not be betray'd, he inspired them with the utmost contempt for the rest of Mankind, as having made themselves unworthy of those great discoveries by their superstitious prejudices. Just such a proud sort of men were the

*Gnosticks*,

(1) Har. *Gnosticks*, if we believe Epiphanius. (a) We, say they, are men; all the  
 34. n. 5. rest are but Swines and Dogs: and therefore it is said, do not cast your  
 Pearls before Swines, nor give that which is holy to Dogs: in consequence  
 of which, they had set this constant rule to themselves, not to reveal  
 the Father and his Mystery to any, but to keep it private amongst themselves;  
 or if they chanc'd to discover it, that it should be as to one in a Thousand, or  
 to two in ten Thousand. Plato's Metaphysics are pretty obscure. Whe-  
 ther this proceeded from that he only related some ancient Traditi-  
 ons, which he had learned from the Caldeans and Egyptians, and to  
 which he durst not add any thing: Or whether it came from thence,  
 that he had not well digested his matter, I shall not now inquire;  
 but upon the whole it appears, That this Philosopher established se-  
 veral Principles, generated by, and subordinated to each other.  
 According to that pattern, the *Gnosticks* had framed a phanciful  
 Genealogy of Deities, all derived from the eternal and ungenerated  
 Father, which numerous progeny, they call'd by the general name  
 of *Æons* or *Ages*; besides the particular names of each of them.  
 7. As the Gospel was chiefly preached to the *Jews*, and that Pa-  
 ganism produced but few Converts before the ruin of *Jerusalem*,  
 the Apostles had no occasion to conceal the Divinity of Christ,  
 and the Mystery of the H. Trinity; which were partly acknow-  
 ledged by the *Jews*, and needed only a farther explication and ap-  
 plication: and therefore they are plainly taught in the sacred Writ-  
 ings, as appears by the vast number of passages our Divines quote  
 against the *Socinians*. But the *Gnosticks* are as ancient as the middle,  
 or at least the end of the first Century, since they derive their Pedi-  
 gree from *Simon Magus*, as Dr. *Hammond*, and lately his Grace my  
 Lord of *Canterbury*, have learnedly prov'd; and therefore they did  
 not take that Custom from the *Orthodoxes*, amongst whom it was  
 not then in use. 8. This scrupulousness crept into the Church by  
 degrees, and it seems that the ancient Fathers grew more and more  
 precise, as they observed the weakness of the new Converts, during  
 the Persecution. And as in matters of Custom men use still to refine  
 upon their Predecessors; so this preciseness was, in the fourth and  
 fifth Century, brought to that height, which, if not condemnable,  
 was at least contrary to the true intention of the first Preachers of  
 Christianity, who never designed to conceal the Mysteries them-  
 selves, but only to prevent disputes about their *modus* or manner of  
 being. And this appears by their Liturgy, or form of Prayers, in  
 which besides several Lessons out of the Gospels and Epistles, that  
 were read before all, the *doxologia* was so often repeated, as Dr. *Com-  
 ber* has invincibly prov'd. St. *Basil* in his Book of the *H. Ghost*, c. 29.

men-

mentions an Hymn us'd to be sung in the Evening-service, which has been published entire by the learned Archb. Usher, and runs thus in English. *O joyful light of the sacred Glory of the Immortal, Heavenly, Holy and Blessed Father. JESUS CHRIST, now at the setting of the Sun and the rising of the Stars; we come to sing Hymns to the Father, the Son, and the H. Ghost of God.* Thou art worthy to be praised at all times, with pure voices, *O Son of God, the Giver of life, and therefore the world glorifies thee.* I know not how it may be said that the *Catechumens*, who might sing this Hymn, or hear it sung every day, had no knowledge of the H. Trinity. Add to this, that the instance of *Arnobius* is a plain evidence of the contrary; for all Criticks agree, and St. *Jerom* testifies it, that he composed his Books against the *Gentiles*, whilst he was yet in the lower rank of the Probationers; yet he speaks thus of our Saviour: *And therefore Christ is God in spight of you; Christ is God, I say, for we must say it so often, that we may deafen the Infidels; God speaking in the form of man, by the order of the Sovereign God.* (b) *Et ideo Christus, licet vobis invitit, Deus; Deus,* (b) *Arnob.* *inquam Christus (hoc enim sàpè dicendum est, ut infidelium dissiliat & dis- l. 2. cont.* *rumpatur auditus) Dei Principis jussione loquens sub hominis forma.* gent.

The *Catechumens* were so far from being prohibited the reading of the Bible, that in some Churches, as that of *Alexandria*, they were admitted to the Office of Readers and Singers, if we believe *Socrates* in his Ecclesiastical History, l. 5. c. 22. And how could they be ignorant of that Mystery, when the very Heathens had notice of it, as appears by a Dialogue of *Lucian*, intituled *Philopatris*, where that impious Athiest to ridicule *S. Paul*, and the Christian Religion, induces *Triphon* a Christian, demanding of *Critias* one that he would make his Profelyte, to bind himself by the following Oath to embrace Christianity. *Swear, says he, by the Uppermost, the Great, the Eternal, the Celestial God, the Son of the Father, the Spirit proceeding from the Father, one out of three, and three out of one.*

As to the Objection raised from the many Heresies concerning that Mystery, that were countenanced in the primitive Ages, it may be answer'd by this Dilemma. These Heresies were framed either by *Catechumens*, or by initiated. But *Catechumens* could not be the Inventors of them, for they knew nothing of the matter, according to my Adversaries: and therefore the first Heresiarchs were initiated, and if so, 'tis in vain to alledge the pretended scrupulousness of the Fathers, as an occasion of the birth of errors; since they never concealed the Mysteries from the *Adepts* or Baptiz'd Christians.

And

And now I give it to the acutest Controvertists in the *Roman*<sup>n</sup> Church, to set up this Argument in the finest dress, and to try whether they can make any thing more of it but this; that the ancient Doctors, to prevent scandals and endless disputations, waved a particular explication of the most sublime Mysteries in their public Sermons, reserving it for the private instruction of the *Competentes*, or such, who being already perswaded of other fundamental Truths, were to be admitted to Baptism, as soon as they had express a sufficient Faith and knowledge of those mysteries, and an earnest desire of that Sacrament.

But as to the *Socinians*, I defy them to propose any thing that stands so fair for learning and reason as the Hypothesis of the VIII Letter, so absurd is their System, and contrary to all Antiquity. Just at the cloſe of this, the Answer they have made to your Book fell into my hands; I had the patience to read it over, tho with a great deal of indignation for the scurrilous language and unfair dealings of your unworthy Adversary; seeing withal so much impudence and vanity join'd with such a gross ignorance, for this Scribler seems to have read nothing else, besides the Books of his own Sect, and those of our Doctors which he undertakes to confute. But what surprized me above all is, that a man who makes such a figure in the world as Mr. T. F. and who is entrusted with the money of the Poor, ſhould allow such an infamous Libel to be dedicated to him, and to be publicly declared a *Socinian*, and the Protector of those Heretics, as the Author does in these words. p. 5. *Therefore, Sir, if Mr. Milbourn has prevailed with you—you may for all that abide in YOUR SENTIMENT about the Unity of God, &c.* But *Charity* prompts me to believe that this is Calumny, as well as the impertinent flanders that his malice has vomited against you; at which you will only rejoice, for that our Savior has esteemed you worthy to be a Sufferer for his cause.

This cause has too much strength of itſelf, and has met with too good Defenders to stand in need of my help. However as these Papers may fall into vulgar hands, I cannot forbear to make the following obſervation, to ſhew how much these Pretenders to reaſon argue against probability. Your anonymous Adversary grants (a) that none of the learned men, whose Memory is come down to us, was of his opinion, unleſs it be *Aquila, Symmachus, Theodotion, Artemas and Theodorus*, \* *S. Lucian, Paul of Samosate, Photin, Asparcellus of Ancyra*. But *Aquila* and *Theodotion* apostatized to *Judaism*, *Symmachus* was first a *Samaritan*, then turned *Jew*, and at laſt an *Ebionite*. *S. Lucian* is ſaid to have laid unawares the foundation of *Arianism*,

anism, by some unwary expressions in his Books against *Sabellius*, but has been cleared of this Imputation by St. *Athanasius*, as well as *Marcellus of Ancyra*. The rest are known Hereticks, of whom our Author may boast, if he please, provided he observe that none of 'em liv'd before Pope *Victor* in 180, according to his own Chronology.

In this time it was, that the pretended Apostasie was perfected, if we believe the *Socinians*; *Theodotus of Bizantium* having been excommunicated at *Rome*, for holding that our Saviour was a meet Man. This *Theodotus* was a Tanner by Profession, who having forsaken his Redeemer during the Persecution, fled his Country for shame, and coming to *Rome*, began privately to teach, That tho' Christ had been conceived by the Holy Ghost, yet he was not the Eternal Son of God, but only the most Excellent of all the Prophets. Whether he endeavour'd to propagate that blasphemous Opinion, that he might diminish the horror of his Apostasie, or whether he was employ'd by the Heathenish Priests to sow Dissention amongst the Christians, I cannot tell; tho' I am much inclined to believe the last. For 'tis observable, that most of the first Heresiarchs were Apostates, or dissatisfy'd Men; and when I consider the crafty Devices of the Pagan Priests concerning Divination, Oracles, pretended Wonders, and the like; and withal remember how busie Jesuits and Monks have been to put us together by the Ears, I am apt to imagine that Paganism and Popery resemble one another, as well in Deceit, as in Superstition and Cruelty.

Howsoever it be, *Theodotus* lived several years unknown in *Rome*, till at length his scandalous Discourses oblig'd *Victor* to banish him the Church. He left but very few Disciples, who were so inconsiderable, that during a whole Age there is no mention of them. It was but at the end of the third Century, that one *Artemon* reviv'd *Theodotus's* Blasphemies, pretending that he had been wrongfully condemned, and that the Christian Church was of his opinion in *Victor's* time. The matter was discussed anew, but with as little success for this Heresiarch, as it had been for his Predecessor. This is the substance of the matter of Fact, as it is related by *Eusebius* in the fifth Book of his Ecclesiastical History, chap. 27, &c. 28.

Now I leave it to any impartial Reader to determine, Whether the pretence of *Artemon*, and of the modern *Socinians*, has any shew of probability? Whether 'tis likely that the Christians, who in those early times had so much zeal for their Religion, should have suffered themselves to be thus impos'd upon by one sole Bishop, who had no power beyond his Diocese, or perhaps the *Suburbicarian Provinces*?

vinces? Whether the Prelates of *Asia*, who so bravely withstood this same *Victor*, when he would force on them an indifferent Custom of his Church in the Celebration of *Easter*, would tamely have yielded him the most important Article of Christianity? I know not what the *Socinians* can say to this, unless they turn those blessed Martyrs into so many Politicians, who, to draw on the Peoples veneration, agreed amongst themselves to make the Author of their Religion a God. But our Adversaries, how impudent soever they be, will yet, I hope, clear the Apostles of that blame. Who then of their Successors manag'd that pious Fraud? Surely a few Men could not do it, they had met with too great oppositions; no, not even all the Bishops, tho' they had been all of one mind (which is very absurd to suppose) had not been able to prevail upon all their Diocesans, since it cannot be deny'd but a great number of them minded only their eternal Salvation.

Perhaps our Hereticks will reply, That this Opinion crept into the Church by degrees, as other Errors have done. But an hundred years is too short a term to make such an universal change, and there is hardly so much betwixt the death of St. *John* the Evangelist, and the condemnation of *Theodosius*. Besides, if the Doctrin of the Holy Trinity has been received that way, how comes it that we cannot trace the several steps of its increase, as we can do of other humane Inventions, Transubstantiation, the Invocation of Saints, the Worship of Images, &c. notwithstanding all the endeavors of the *Roman* Church to suppress the Books of her Adversaries? Certainly he who can digest so many Absurdities in plain matters of Fact, I wonder how it sticks at pretended Contradictions, which are nothing near so sensible, when they relate to Metaphysical Notions, and the manner of subsisting of the infinite Being.

In fine, of all the Hereticks these latter Ages have produced, the *Socinians* appear to me the more confident and ignorant, and altogether unworthy of the pains so many learned Men have taken in confuting them: There are others, who are like to create more trouble to the Church, if care be not taken to prevent it: I mean the *Arians*, whom I wish you will not forget in the Book you are preparing for the Press. I have had some thoughts to this effect, but as they are grounded on an ancient Tradition, that would appear as a new Hypothesis, I am loth to publish them.

May 16<sup>th</sup>.

LETTER

## LETTER XIX.

Written in Dutch by Mr. Leeuwenhoek,  
F. of the R.S.

## ARGUMENT.

Of two sorts of Frogs. Observations on the Eggs of Green Frogs: Of what Particles these Eggs are made up. Worms form'd in these Eggs. The Make and Figure of these Worms view'd through the Microscope. The Circulation of the Blood discover'd in six Labels hanging on their Head. Propulsions of the Blood, how swift they are. The same Circulation appearing again sensibly in several places of the Tail of these Worms. That the Vessels which are called Arteries and Veins, are but one and the same Conduit. That the first and original Circulation is made in the smallest Vessels. This Circulation discover'd in the two sorts of Frogs. Of an Artery in which the Blood ran backwards, and what might be the cause of it. An Account of Mr. Leeuwenhoeck, and his other Performances. Reflexions of the Author of these Memoirs on this Discovery.

SIR,

I send you my Observations concerning the generation and growth of Frogs, wherein I have happily found out the true manner of the circulation of the Blood in Animals, which important discovery I hope to improve, and send you a farther account of.

We have two sorts of Frogs in our Ditches: The ordinary ones were formerly in great numbers, but are within these few years mightily diminish'd; because, as I take it, of a kind of very small

Perches, call'd here *Stekel-baarsjens*, which now replenish our Ditches, and eat the Frogs, whilst yet Worms. The reason of my conjecture is, that we had seen none of this Fish before.

The other sort of Frogs are bigger, but not so common; we call them here *Worken*, and the *French*, who eat the hinder part of them, *Grenouilles Vertes*, or Green Frogs. It is on these Frogs I have made the following Observations. Their Eggs are not so easy to be distinguished as those of the ordinary Frogs, because the viscous matter, in which they are wrapt up, does not swim in so great quantity on the surface of the Water. However having happily met with some of 'em sticking to some green Weed, I brought 'em home, laid 'em in two earthen Vessels, and examining them with my *Microscopes*, I perceived that they were for the most part brown on one side, and yellow on the other. But when I came to observe them the following day, the yellowness was almost vanish'd, a very small part of the Egg only keeping that color; whence I concluded they were but newly laid.

Moreover, I took several of these Eggs out of the transparent and clammy matter with which they were surrounded; but tho' it seem'd to separate itself in two distinct Circles; yet it was so tough and viscous, that how tenderly soever I manag'd it, I could not take out the true Egg, without breaking or rending it, or altering its shape. Notwithstanding having loosened some of these Eggs, the best I could, I observ'd that their membrane, or the thin skin in which they were wrapt up, was made of little black points, not much unlike the knots of Shagreen; that the Egg consisted of a small quantity of waterish liquor, and an incredible number of globules, each of which was compounded of divers smaller ones, and each of these seem'd to have a greater globule in the middle; so that every first globule might be compared to an Egg with a little yolk in the middle.

The figure of these Eggs chang'd from day to day, and grew oblong instead of round: The tails of the Worms were first discernible, and afterwards their heads. In the mean while I open'd every day some of these Eggs, especially on the seventh day after I had carry'd them home, when some of the Worms were already so far grown, as to have a motion: However I could perceive nothing in them but globules: and even after the Worms were hatch'd, and swam in the water, tho' I could distinguish their back-bone, yet when I cut them through, I could observe neither bowels, nor arteries, nor nerves. For it appear'd to me as if the whole Worm had been nothing but globules, especially the belly, which was yellow, being made

made up of that part of the Egg that had kept that color. And I was strangely surpriz'd, that I could perceive, neither vessels, nor sinews, in a creature so big, as to live and move to the naked Eye.

Out of these Observations I concluded, That the viscous matter, which surrounds the Egg, is made only to preserve it, and to feed the young Frog or Worm, till it be able to shift for itself: So that the same thing happen'd here as in the Eggs of Birds; wherein all the inward substance of the Egg, *viz.* the White and Yolk turns into the substance of the young animal, only the shell and the membrane that sticks at it, remaining unchanged.

I likewise perceived several bubbles in this viscous matter, which I look'd upon as a wonderful providence of Nature's wise Author; for these Eggs might chance to lack green to hang upon, whereas now by the help of these bubbles, they may swim on the water, to enjoy the warmth of the air and to be brooded and hatch'd out.

For your diversion, and the better apprehending of my observations, I have caus'd one of these Worms to be drawn to the life (a) See few hours after it had rid itself of the clammy substance wherein it lay) by a very skillful designer, so as he view'd it through the Microscope (a).

*Fig. 1* represents the Egg. *Fig. 2* the Worm just hatch'd out, both as they appear to the naked Eye. *Fig. 3* is the same Worm view'd through the Microscope, wherein LM NOP, represents the head; HIRS the belly, GHS the tail. Above the head appears part of another skin, mark'd here MNO, which by reason of his thickness, I suppose to be part of that skin, that is to cloath the Worm again, when it is grown a perfect Frog. T shews the mouth, which I never saw this little creature open at that time. VV are two brown spots on the head, which by reason of their circular figure one would be apt to take for the Eyes, were it not that the Eyes cannot be perceived, when the Worm lies in that situation, its belly towards the Spectator. IKL and PQR are six transparent *Pendants*, or six several Labels that hang three on each side of the head.

It's chiefly by reason of these Labels, that I caus'd this Worm to be drawn, for that in each of them I distinctly perceived the circulation of the blood, going from the parts nearest to the body, to the remotest from it, and making a continual and very quick circuit, tho not with an even motion, but with such propulsions as follow'd very close one upon another; so that in the interval of each propulsion, the course of the blood seem'd to retard, and one would have thought there was a stop in it, had he not presently perceiv'd the rising of the vessel, and the next propulsion immediately following.

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I endeavoured to measure the intervals of these propulsions or pulses, and found that they equall'd, or even surpass'd, the telling of an hundred, how fast soever the numbers be pronounced: whence I infer'd, that the blood was expell'd out of the heart, as oft as these pulses were performed; which, together with the going over of the blood out of the arteries into the veins, I perceived as plainly as can be imagined.

This curious sight I communicated to five Persons of Quality, who were extreamly pleas'd with it. If you ask how we could be so sensible of this circulation? I answer, that this blood does not consist of particles of an even bigness, but that it is made up of smaller and greater globules, which tho' they have no color, yet the whole liquor is so bright and shining, as to be easily perceptible.

Some days after the birth, or hatching out of these Worms, the labels were vanished, being doubtless united to the rest of the body, and overgrown with a new skin. And tho' I still perceived a very quick motion on each side of the head, yet I could not discern any circulation of the blood, nor even any distinction betwixt the head and the rest of the body; they were now join'd together so immediately.

When the Worms were 8 or 10 days old, I observed that they opened and shut their mouth with the same quickness of motion, that I had been sensible of in the forementioned circulation; by which means I came to discover their teeth, which were so perfectly grown in rows, that they resembled those of a Dog fish.

To get a greater certainty concerning this new way of the circulation of the blood, I continued to examine these Worms that were then 8 or 10 days old, and perceived the motion of a small particle within their body, which I took to be their heart, especially because the matter, that was expell'd out of it, began to grow red. This particle had as swift a motion as that of the foresaid arteries, and as oft as it mov'd, the Eyes of the little creature got some motion too; and therefore I imagined, that the motion of the Eyes depended on the motion of the heart and mouth. These Eyes were round, sticking out of the head, had a black speck in the middle, and appear'd as plainly to me as the Eyes of any little animal use to do to the naked sight.

I opened the belly of some of these Worms, and observed that their bowels lay in round, and were filled with a brownish matter. But my greatest diversion was the examining of their tail, in which I discover'd above fifty windings of the blood in several places, as oft as I could conveniently lay the animal living in the water before my

Micro-

Microscope. For I not only saw in many places, the blood carry'd through small vessels from the middle of the tail to the extremities; but even perceived each of these vessels bent like a bow or syphon, to carry the blood again to the inward parts of the tail, and from thence to the heart. This made it evident to me, that the vessels, which we name arteries, and veins, are the same conduits, that may be called arteries, as long as they carry the blood to the extremities; and veins, when they bring it back to the heart. For instance, I saw several vessels in the tail of these Worms, running as *A B C*, *Fig. 4.* now *A C* lying toward the bone of the tail, and *B* toward the extremities of it; *A B* carries the blood from the heart, and *B C* carries it again to it; so that the conduit *A B C* is together an Artery and a Vein. For such Vessels are called Arteries and Veins, in reference to their leading the blood from, and to the heart; but the conduit *A B C* does not carry the blood farther from the heart, than from *A* to *B*, and at *B* it begins to carry it back to the heart through the branch *B C* of the same conduit; and therefore an Artery and a Vein, at least in these little animals, are but one continu'd Vessel.

These Vessels are so straight, that they admit but one small globule of blood at a time, which globules are often forc'd to take an oval figure, that they may have a free course through them, especially when the little creature is put out of the water, and ready to die; for then the blood makes frequent stays in the smallest Arteries, and at each new propulsion of the blood, these globules are stretched twice as much as their natural length, and grow sharp-pointed at both ends. In another place, I observed one of the biggest conduits dividing itself into two branches, as *Fig. 5.*, *D* does in *E*, with *E F* and *E G*: so that if *D E F* and *D E G* are supposed to be Arteries, because they carry the blood from the heart; *F H* and *G I K* shall be Veins; because they carry it back to the heart.

I likewise perceived another small Vessel *M L* uniting with the Vein *I K*; so that tho *H F* be a Vein, *D E F* and *D E G* Arteries, *G I K* and *K I L* Veins, and *M L* an Artery, yet they are but a continued Vessel.

In another place, I observed three of the smallest Arteries, bending bow-wise, and uniting together in one point, where they made up a Vein, that was consequently as big as the three said Arteries, which however were so small that all three together, with all the space through which they circulated, might have been covered with an ordinary grain of sand.

I have.

I have often perceived an Artery running across of a Vein, and had not the particular course of each been distinguishable, it might have induced so far into a mistake, as to make one believe, that the circulation was performed through that Vein. This crossing I have been sensible of, not only in the smallest Vessels, but even in such as were ten times bigger than those through which the blood did circulate.

I had formerly been aware of such crossing conduits, when I laboured to find out the union of the Arteries and Veins. But, being perswaded that the original and first circulation of the blood was not made in the biggest, but in the smallest Vessels, for otherwise all the parts of the body could not be nourished, I had laid aside all the thoughts of this nature, supposing such a discovery impossible. And now that it plainly appears that in these Worms the blood is carried from the Arteries into the Veins by such straight conduits as will only admit one particle of blood at the time; we may reasonably suppose, that it is performed the same way in us, and all other animals. And if it be so, then it is impossible, that we should ever be sensible of the passing of the blood from the Arteries into the Veins; First, Because one sole globule of blood lying in a most small and strait Vessel has no color. Secondly, Because the animal being either dead or a dying, or at least very uneasy, when we are about this search, the blood stops in the said conduits. Add to this the unimaginable smallness of these Vessels, of which to be fully perswaded, we need but remember what I have noted elsewhere, that they let pass but one globule at a time; and that these globules, which have no color in themselves, but by their junction make the blood appear red, are so little, that ten thousand of them would hardly amount to the bigness of a large grain of Sand.

I have reiterated these delightful observations several times, upon different Worms, and almost always with the same success. Amongst other things I took particular notice of this, that the propulsion of the blood is not so swift in the small conduits that lye at the end of the tail [Fig. 3] and remotest from the heart, as it is in those that are placed about it.

At each side of the tail bone, I perceiv'd a great Artery running in length, carrying the blood to the end of the tail, and spreading itself into several branches. At the sides of these Arteries towards the extremities of the tail, I discover'd two great Veins, which carry'd the blood up to the heart, and were increased by several little Veins, that discharged themselves into the great ones. And even I perceived in a small part of the tail, that the blood of the Veins circulated

circulated in above 25 distinct Veins. Besides these Veins I observed in the tail a vast number of other Vessels, with their several branches, which at last divided themselves into so many other branches, that they vanished out of my sight. These Vessels issued out of the middle of the tail; but how attentively soever I followed them with my Eye, I could not be aware of any running of the blood through them, tho these Vessels were bigger than those wherein I had so clearly seen the circulation; which made me conjecture that these Vessels were rather Sinews than Veins.

I communicated this pleasant prospect to two learned Gentlemen, shewing them not only how the blood was carry'd along the great Artery to the end of the tail, and thence through the great Vein upwards to the heart; but I made them also sensible how in several places the blood was carry'd through the smallest Vessels to the extremities of the tail, and thence carry'd back through the little Veins to the inward parts of the said tail.

I continued my observations on these little creatures, even after they were grown so far from a Worm to a Frog, as that they began to leap in the Fields, and then also discover'd a vast number of small conduits, which by their many and continued windings made up those Vessels, that are commonly called Arteries and Veins. But I perceiv'd the circulation in no part of these Frogs so sensibly, as at the end of the Toes, where the flesh rises more eminently. There these conduits are in so great number, and make so many windings, that my Eye could not follow them; besides, they were so small and narrow, that they let pass but one particle of blood at a time. But when I came to view those about the first or second joint, I perceived bigger Vessels, wherein the blood began to grow red. And 'tis worth taking notice, that I made these observations without cutting the young Frogs, but placing them entire and alive before the Microscope.

I found at first more difficulty to discover the circulation of the blood in green Frogs, but at last it succeeded in them too. And what is most remarkable is, that I perceived the blood of an Artery, big enough to let pass three globules of blood, running back for four seconds, and then following its ordinary course. For instance in the great Artery N P R O, the natural course of the blood is from N to O, and therefore that of the branch P Q ought to be from P to Q; whereas it happen'd sometimes that its course was stopp'd on a sudden, and even that it ran backwards from Q to P, and empty'd itself in the Artery N P R O. The cause of this Phænomenon I suppose to have been, either some stoppage of the blood

in the Artery P Q, or in the branches into which it subdivides itself, or perhaps some strange compression of the muscles or sinews, lying next to these small conduits; that hinder'd the course of the blood, and even made it flow back for a short time, after which it pursued its course as vigorously as before.

In another Artery much like to the former, I observed the course of the blood retarded for a short while, whereupon followed a sudden propulsion: then the blood grew slower; then it was pushed forward again, and after five or six such reciprocal stops and propulsions, the blood took again a swift and even course; and all this in the space of a minute, or less.

Mr. Leeuwenhoek being so deservedly famous in the learned World, the Ingenious will undoubtedly be glad to have an account of him. He is about 50 years of age, but has already employed 15 or 20 years in Observations as curious as these, which I have here related. His Parents designed him for a Chyrurgeon, which Profession he has exercised some time with Honor. And as he rightly conceived, that Anatomy was the foundation of that useful Art, and that Microscopes were highly serviceable to acquire the knowledge of it, he applied himself not only to perfect those that were already in use, but even to invent new ones, in which he has succeeded to admiration, having discovered amongst other things more kinds of invisible Animals, than the World before him knew there were visible ones: and withal made an anatomical description of many of them. The perfection to which he has brought his Microscopes, has afforded him great light For they are not big and cumbersome tools, as the ordinary ones; but light and portable, consisting only of a glass or two at the end of a small and short tube, so that he may manage them, and apply them to the object, as easily as his own Eyes. And what is still more wonderful is, That tho his Glasses magnify the Objects far beyond any I have seen, yet they do not darken it. To which if it be added, that he is an able Surgeon, and has made it his chief business during many years to dissect and view little Animals, Plants, Seeds, Eggs, Saps and the like, his surprizing discoveries will become more credible. I know some are apt to imagine, that this curious Observer of Nature imposes at least upon himself, in several things which appear to them undiscernible. But as to the matter of fact he relates, I dare answer for his sincerity, having myself tried his Microscopes, viewed several things through them, and found them conformable to his relations. Besides, he is very free to let Objects be viewed through his Glasses, and to communicate his Observations to Gentlemen of Learning and Credit, especially Travellers: but he has made so many of them at all seasons and times of the year, that the Thousandth part cannot be examined by those that repair to him on that account. There is a Volume of his Observations printed in Latin, some of which are inserted in the Philosophical Transactions,

and I have by me some other very curious, which I shall publish in due time.

The discovery he has made in the Letter, I give now to the Public, will perhaps not appear very new to those that do but slightly consider things of this nature. But the Learned know we were sure of the circulation of the blood, rather by reasoning than by experience. The Arteries and the Veins had been observed to have communication together, the Arteries to carry the blood from the heart, and the Veins to bring it back to it: But how the great Arteries divided themselves into small conduits, and these again into smaller, to spread and refine the blood, and bring nourishment and substance to all the parts of the body: How these little channels after several windings discharged the blood into the Veins, to be carry'd back to the heart, and how the blood grew red by degrees, by the junction of several of its primary globules, is what was only, or at least chiefly, known by conjecture.

We are pretty certain that Fountains and Rivers owe their original to the Sea, into which they empty themselves by a continual circulation. But whether they are supplied by Vapors and Rains, or by the steams of subterraneous Waters is still controverted amongst Philosophers. It's somewhat to prove, as (a) See my ingenious Friend has done (a), that the gravity of the Atmosphere hinders the rising of the water above its level, as effectually as would do a floor of Quick silver 28 inches in thickness and weight: so that it is no wonder that in subterraneous channels, where the water is freed from that pressure, it should rise to the top of Mountains, being still lighter than the ground under it. But how should we repay him, who should shew us some of these Channels, and let us view the water ascending from the Sea to the spring of Rivers, as far as the Ocean is from the source of the Rhine? It's what Mr. Leeuwenhoeck has done, as to the circulation of the blood, as the Reader may judge by this Letter, tho' what he has seen be but an essay of what shall follow hereafter.

May 23d.

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## LETTER XX.

To Mr. R. Sault.

## ARGUMENT.

*Occasion of this Letter. The Matter of Fact cleared from all doubts as to the discovery of a Murther made at Lyons. Why the French Court endeavors to cry down the credit of James Aymar? The prodigious Numerousness of the Effluviums of living Creatures. Instances of the wonderful effects they can produce by their vast Numbers; of their working on living bodies without an immediate Application; of their affecting some Persons, and not others. Why Aymar can trace out Murtherers on a River, tho Set-bounds lose the scent of a Deer, when it crosses the Water? Why these Effluviums are not carry'd away by the Wind? Whether the Confession of the Criminal diminishes the credit of the Relation, as to the Discovery?*

SIR,

THO I should only follow the rule I have prescribed to myself, to dedicate none of these Letters but to Gentlemen of Merit and Learning, with whom I have the honor to be acquainted; yet knowing you to be a good Philosopher and Mathematician, you have consequently a natural right to some of them. But besides that, I am informed, that I have to you a particular, tho very private obligation, it being credibly reported, that you are the chief Author of some weekly Papers, in which that part of my *Memoirs* relating to the Divining Wand, is honorably mentioned. I might in requital tell the world that there are some pieces of yours, especially your Dialogues concerning the Existence of God, and the Immortality

tality of the Soul, which are as methodical, strong and ingenious, as any I ever read. But tho in this I should not injure the truth, yet your modesty would suffer thereby, and it might look like a correspondence amongst Authors, who cast praises at one another, as Players do a Ball in a Tennis Court.

And therefore, since you have been pleas'd to refer the curious to me, as being the first in this Country, who has pretended to give a philosophical account of this surprizing Phænomenon; I think it more proper to afford you and the public all the satisfaction that possibly I can. First then as to the matter of fact, I heard of it two months before *February* last; and tho at the reading of the first relation I was pretty neer persuaded of the truth of the story; yet it appear'd so strange to me, that I thought it fit to wait a further confirmation. So that before I committed it to writing, I confronted no less than four relations, all drawn by different hands, and varying in some little circumstances, tho agreeing in the main. And as this agreement convinced me of the truth of the report in general, so those inconsiderable variations made it evident to me that there was no plot in the case.

Besides this, I knew the tenderness and care of the Magistrates of *Lyons*, as to what concerns mens lives, they having deliver'd me from the hands of the persecutors of our Religion, and releas'd me, without any ignominious usage, no not so much as a fine, tho I was prisoner at the Kings suit, and threatned with no less than the Gallies, or a perpetual imprisonment. Add to this, that I was certainly informed the matter of fact was so little doubted in *France*, that several learned Eye-witnesses, Physicians and Philosophers, had already written, or were writing upon it.

I let you judge, Sir, and all impartial Readers, whether, after all this, it may be said that I have suffer'd my self to be impos'd upon, to have occasion to deliver some glittering conjectures? But, reply they, *Monsieur le Prince* has examin'd this *James Aymar*, and found that he was a meer Cheat. What? that he had blinded the Court of Justice, and the whole College of Physicians of *Lyons*; who by all the motives of Conscience and Honour were so much concerned to examine the matter, and not to suffer themselves to be made a laughing-stock to the World? If so, surely *James Aymar* must be a shrewd Country-man; and 'tis withal very strange, that being so crafty, he could not deceive his Highness, to whom the Relations we have of the *French Court*, give rather the Character of *Achilles* than *Ulysses*. And what is yet more wonderful is, that a person of that quality should descend so low as to accompany *Aymar*

to places, where it was pretended that Murthers and Robberies had been committed. Nay, the *French* King himself would needs have him to *Versailles*, and his Royal Brother to *Chantilly*, to try the vertue of the Divining Wand. But most unhappily the Wand would not turn at their presence, if we may believe a Letter inserted in the *Journal of Paris*, 1693. N. 16. This extraordinary care, joyn'd to an unwary expression in the said Letter, *That Mr. le Prince doubted of the vertue ascribed to the Wand of Aymar*; would tempt one to believe that those great Politicians, whom specious pretences of State prompt so often to make a man privately away, do not think fit to let grow the reputation of a discoverer of Murthers. And therefore that the same prudence that hinder'd our Peasant from making use of his Wand in the Camp of *Sablon* (a), suggested him not to let it play before such powerful men, who appeared unwilling to be clear'd of their doubts. I might also surmize the great and sudden alterations which fear produces in mens bodies, so far as to benum their senses, that they cannot perceive sensible objects at a competent distance; much more then will this passion, heightned by an eminent danger, and the presence of a King or Prince, stop or alter the pores of a man, when they require such a nice and particular texture, to be sensible of effluvia, which do not affect other persons. But I need not to be so inquisitive, for the testimony of the Physicians of *Lyons*, and of the Witnesses who accompany'd *Aymar*, during his tracing out of the Murtherers, being still unshaken, and the Judgment of the Presidial of that City having not been reversed by the Parliament of *Paris*, as it would undoubtedly have been, had the *French* Court been able to find fault with it, this discovery remains incontestable. And thus I have as much as I can desire: For whether this Countryman has lost his gift by some sudden fear or distemper, or whether his simplicity has been abused, is what I am not concerned to examine. I own I related the History of *Lyons* in such a way as shew'd that I was perswaded of it; and it would have been ridiculous in me to trouble my self or the Reader with the Physical explication of a Fable. But one single instance being as good as a thousand to ground my conjectures, if that history be true, my endeavours cannot but be commendable.

The objections that have been made against my explication may be reduced to these 4 heads. 1. Why these effluvia are so powerful as to disturb this Peasant, and by that disturbance to direct him to the way of the Murthereis? 2. Why they do affect him and not others? 3. How he can follow the Criminals upon a River, since the best Set-hounds lose the scent of a Deer when it crosses the Water?

(a) See

Feb. p. 35.

ter? 4. How it comes to pass that the Air being a fluid, these steams are not carry'd away with it, or at least cast down to the ground, but remain floating for several days and months, almost in the same place where they had been exhaled.

I have answer'd or prevented most of these objections in my VI Letter, and am loth to repeat the same things over and over. However, that I may clear this matter once for all, I shall endeavour to say something new to each of these questions, as far as the compass of these Memoirs will allow.

1. As to the first, Why these *effluvia* are so powerful? I answer, because they are very numerous, which appears, 1. by the quantity of the food we take in every day, whereof 3 parts in 4, and in some persons 7 in 8 are exhaled in steams. 2. Their numerosness is increas'd by their extraordinary minuteness: for if you remember what Mr. *Lecurenhoek* has observed and made sensible in the foregoing Letter, there are Conduits in living bodies so very small, that they only admit one single globule of Blood, whereof ten thousand together would hardly amount to the bigness of a large grain of Sind. 3. And yet the particles that are expell'd out of living bodies must be still smaller than the minutest globule of blood; for they cannot be driven away but by corpuscles that are stronger and bigger than they are.

Now that corpuscles, otherwise very weak and small, can by their vast numbers produce wonderful effects, appears by a thousand instances, of which I shall only quote this single, but very sensible one. Take a Rope, with a hundred pound weight hanging at the lower end of it, and suspend it in an open place so, that the weight having stretch'd the Rope as far as it can, it does but just touch the ground; if there happen a small and thick rain (as is very usual in this Country) that thoroughly wets the Rope, you shall observe it to shrink, and to lift up the weight at a considerable distance from the earth, as two or three fingers broad, and even keep it up, till the Rope drying by degrees, the weight stretches it again to the ground. So that the weakest body that we know of, viz. the small drops of common water, creeping into the pores of the rope, and swelling the threds of the hemp, can by their numerosness raise up a weight, which neither the wind, nor a man of mean force, would be able to move.

But it will be objected, that the drops of rain swell and shrink the rope by an immediate and sensible application, whereas we see no such communication of the effluxes of the Murtherers into the body of the Discoverer. But must we deny whatever is not visible?

ble? then we must doubt even of the effects of the wind, tho it throws down Houses, and plucks up Trees by the root, and ascribe it to some occult quality. The application of these steams is sensible enough, since it so mightily disturbs our Country-man, and is withal immediate, tho the corpuscles of the air serve as vehicles to them, and that they be kept and preserved in their hollow blades. For they display their virtue as soon as they are entred the pores of the Discoverer, and that as quick and even quicker than any other venom.

See p. 37.

If it be urged that the ordinary quantity of our daily food can never produce such a vast number of steams as is supposed in this hypothesis: I answer, that the aliments we use are very compact bodies, which, being reduced into fumes, will fill a space a thousand times bigger than that which they took up in the state of bread, meat or drink. This appears by the instance of an *Aeolipile*, wherein an ounce of common water heated on a Chaffingdish, will emit vapours of 20 or 25 inches in length, and an inch diameter about the upper end, during 16 or 18 minutes. And I doubt not but bread, as it's more compact, will also take up a far greater space, when reduced into exhalations; since a pipe of Tobacco, which is hardly the 12<sup>th</sup> or 16<sup>th</sup> part of an ounce, casts forth such a prodigious quantity of smoak, as fills a whole house with the smell, and would make up many score Yards, if it could be measured: besides a vast number of spirituous and oily particles that enter into the body of the Smoaker, or stick at his Pipe, and a considerable deal of *Caput mortuum*, and Ashes.

II. As to the second question, why these *Effluvia* do affect this Peasant, and not other men: I answer, That it is an effect of the wise Providence of God, that the emanations of an Animal are for the most part not hurtful to others; since it is evident that in such a case they could not long subsist. But some occasions wherein the same Wisdom has thought fit to give them repugnant qualities, are sufficient to shew the power of their effluxes. I shall not insist on what is related by ancient Authors of the *Basilisk*, that it darts its venom by its Eyes, that its steams kill the greatest Serpents, and even those Persons who touch it with a long Pole; that it burns the Herbs, and dissolves the Stones over which it passes. I easily grant that some fictions may have been suffered to pass under the countenance of so strange a truth, but am loath to take the whole relation for a fable, not only by reason of the authority of *Galen*, *Elianus*, and *Pliny*, but especially because the last who was accounted so credulous, begins to get in greater credit than ever, since our latter navigations and experiments have manifested the truth of many of his Relations.

What

What is reported, by *Cicero* and *Pliny*, of the *Torpedo*, or Cramp-fish, is not so much contested, and will do as well for my purpose. This Fish is not very nimble, but compensates its natural heaviness by craft, for it hides itself in the mud that lies on the bottom of the water, as tho it knew that its steams have the power to benum the fishes that shall chance to pass over it, and that then it may come and devour them at leisure. It's farther observed that this fish is not to be kill'd but at a distance, and with arrows and guns, for if you venture to touch it, tho it be with a long peacock, it will presently cramp your arm.

I might add other instances of the effluvia of animals working on living bodies, without an immediate application of the agent to the patient, as what is related by *Piso* in his History of *Brasile*, l. 5. c. 14. of another sort of Cramp-fish called by the Natives *Amorcas*, which if a fisher chance to tread upon, tho he have shoes on his Feet, yet he will presently be seized with a kind of *Paralysis* and Stupefaction. And *Scaliger* \* testifies that in *Gascony* his Country, (†) *Exere-* *there are Spiders of that virulence, that if a man crush them, their* *cit. 186,* *poison will pass through the very sole of his Shoes.*

But it will still be surmiz'd, That these steams are poysoneous in themselves, and to all animals whatsoever; whereas the effluvia of the Murtherers require a particular texture in the Patient to become sensible to him. I grant it, but instances of this are likewise to be found. Pray, Sir, what teaches a young Dove or a Lamb to fly from a Hawk, or a Wolf, tho the young Beasts never saw their Enemies before. You never heard of an unexperienc'd Child running from a Viper, or a Wild Beast, unless it be terrified with their whistlings and howlings. But tho a Wolf endeavors to approach a Lamb in a soft and deceitful manner, yet the innocent Creature does no sooner smell or perceive the rapacious animal, but it makes away with all the haste it can. I know what is used to be said in this occasion, That the imagination of the Sheep, Mother to the Lamb, having been often frightened with the image of a Wolf, has imprinted the same horror on the brains of her young. This is something, indeed, tho it had withal to hold true in Children, in reference to things that are hurtful to man, which however it does not. But let's take this for a sufficient answer; I ask still what is't that advertises the Lamb, that it is in the presence of the Wolf, especially when it does not see it. Certainly it can be nothing else, but the smell of its Enemies emanations. And therefore there are emanations which are hurtful to some Animals, whilst they do not affect others. But we need not go farther than our

own houses to find the like instances; for those places, which our Cats use to frequent, are soon deserted by Rats and Mice, the smell is so noisom or frightful to those insect<sup>s</sup>.

I should never have done, should I speak in particular of the aversion which some have for the smell of old Cheese, of Tobacco, and even of Musk, Ambre greese and Roses. And therefore I shall conclude this Article with observing, that tho' I cannot give a proper and particular description of the figure and shape of thele odoriferous Corpuscles, nor of the Pores they are receiv'd in: yet this is sufficient to infer that the Pores of humane bodies are very different, since what operates on some will have no effect on others. Not to add that the weakness of ones temper makes his body very sensible, as Children, Ladies, and sickly persons use to be offended at several things, which men of a stronger constitution and inured to pain and labour do not take notice of; and some diseases refine the hearing to that degree, that the Patient perceives the least noise that is made in the house: as I have had sometimes my smell rendred so nice and tender by the head-ach, that I could not walk through the streets, the odours I met with at every step were so troublesome to me. I am credibly informed that in a long Sea-fight, wounded Souldiers, especially such as have had any bones broken, do oft complain of the torment they are put into, by the shake they feel at the going off of the Enemies Cannon. And the learned *Simon*

(a) *De Fe- Paulsen* testifies (a) that the same hapned to one who had lost his *tribus me- right Arm by the Gangreen.* For he cry'd out most lamentably at *lignis. p. 71* every time that a great Gun was discharged, tho' he was in a Country house, and so far from the Sea, that the report of those Cannons could hardly be heard by the Persons that were near him. *Platerius*

(b) *Obser.* relates an observation, which is still more surprizing: (b) A woman *I. i. p. 185.* fell into a sudden sickness, and Nature failing her as in an instant, she perpetually groan'd, that she was choaked, tho' there appear'd no signs either of snorting or coughing. She especially complained of a wind that came upon and oppressed her, if any of the Assistants mov'd but ever so little. But when any came near her, then she cry'd out that they smothered her. She lived but two days in that perplexity and so died.

It will be excepted against the two last instances, that these effects are produc'd by the motion of the air, and not by any emanations. But besides that in the former, the air is mov'd by the vapors of the Gunpowder, and in the latter by the effluxes of Men; it suffices for my present design, *viz.* to render a pertinent reason why the effluviuns of Murtherers affect this Peasant, and not other persons,

persons, that I prove that an unheeded motion and insensible corpuscles are able to produce violent and surprizing effects in humane bodies, when disposed some certain way.

III. It's no hard matter to resolve the third Objection, *That Set-hounds lose the scent of a Hare or a Fox, when it crosses the Water, and therefore that it's not conceivable how Aymar could follow the Murtherers on the Rhone.* For 1 Set-hounds hunt out Beasts of Game only with their Nose, in which they receive the corpuscles that steam out of the Feet of those Beasts. But our Countryman traces out Murtherers by the emanations that exhale out of all the parts of their body, and penetrate through all the pores of his own, and perhaps too, in those of his Wand. 2. A Hare or Fox swims over the water, that must needs carry its effluxes away; but Men go over a River in a Boat, so that their effluviums may as easily disperse themselves through the air that lies on the surface of the Water, as through that which floats near the ground, and none are lost but some few, that now and then are cast down; which however is the cause why *Aymar* is not so vehemently affected, when he pursues (1) See Murtherers on a River, than when he traces them out on land (a). p. 41.

IV. But the last and grand Objection is, *How these effluviums may be hidden so long within the hollowness of the aerial blades.* In vain I have supposed, and even demonstrated, as far as such matters can be, that these steams are extraordinary small and rigid, ponderous and clammy: this cannot satisfy some People, who seem to imagine the air as a River, that runs perpetually from East to West. But to grow more favorable to my hypothesis, they have only to substitute to their River a vast Lake; or rather an Ocean, which will afford a truer Idea of the Atmosphere, especially, if they conceive no tides in it, or at least neither Capes nor Coasts to vary its course. Now tho the particles of this Ocean be in a perpetual motion, tho they may be by the Wind raised up, and cast downwards, toss'd to and fro, and even propelled North and South, East and West, to a considerable distance; yet this World being full, or almost full, they cannot stray very far, or at least very long, from the usual place of their abode; but will soon reflow to it. Thence it comes that contrary Winds do ordinarily succeed each other, and that the air of the respective places remains still almost the same, save the usual difference of seasons.

Add to this, That Bodies cannot be driven forward but by Bodies stronger than they are; and that amongst the aerial blades, those are doubtless the strongest and least moveable, which are replenished with these hard and ponderous effluviums. Thence it will follow

low that when the Wind puts a certain part of the air into motion, its empty corpuscles are either repell'd back, or forced to glide along the sides of the full ones, which therefore keep still constantly their place.

If it be objected that the replenish'd blades being so heavy, ought to fall immediately to the ground. I answer that they may be hard and ponderous enough to resist the soft impression of the empty corpuscles that swim about 'em, without having a weight sufficient to force upwards the whole column of the air that underprops them.

I might add instances of contagious steams preserved a very long time in several moveables, but I need not to be so precise, for I only undertook to defend the Relation of *Lyons*, in that part relating to the Discovery of the Murtherers, which was made a few days after the crime had been committed, and appeared to me undenial by reason of the sentence of the Presidial, and the Testimony of the Physicians of that City. Some of the incredulous, to save the honor of the Court, say that they condemned the Criminal upon his own Confession. I grant that he confessed, tho' not at first, but when he could no longer resist the pressing evidence of all the Land-lords at whom he had lodged in his flight : So that his very confession which he made, without being so much as threatned with the Rack, is a strong proof of the truth of the Discovery.

I am sensible that all the reasons and instances of this, and of my former Letters, will not perswade some Pretenders to Philosophy, who measure the vast extension of possibilities by the shallowness of their conceptions, or who, to appear learned and subtile, at a few expences, cut short, through all the difficulties by a denial of whatsoever they can give no good account of. But I hope a more ingenuous usage from you, Sir, who are accustomed to consult Reason, free from passion of Prejudice, and even, as I am informed, are going to enrich the World with a new art of reasoning, grounded upon the sure and unshaken Principles of *Algebra*.

May 29<sup>th</sup>.

F I N I S.